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Catalog of overhead telecommunication lines on composite poles

VOLUME I - optical fiber lines

Author of the study

APG projekt

Poznań, may 2019

Manufacturer of EKO composite poles

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new quality in telecommunication

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Poznań, may 2019

Table of contents of the volume

I. Technical description str.

1. Subject and scope of the study....2
2. Pole markings due to their function in the line....2
3. Pole markings due to the solution....2
4. Design principles and selection of line elements....3
5. Line types, span widths, stresses and maximum tensile strength 3
6. Hanging of the wires 5
7. Telecommunication composite poles and EKO composite poles 5
8. Types of poles - scope of application 5
9. Foundations for the installation of poles....5
10. Types and structures of footing elements....7
11. Making of foundations for the poles....8
12. Grounding and protection against electric shock....8
13. Line assembly instructions....8

II. Pole album card

1. Through-pole P....10
2. P pole equipment 11
3. Corner pole N 12
4. N pole equipment 13
5. End pole K....14
6. K pole equipment 15
7. Dead end pole KK....16
8. KK pole equipment 17
9. Dead-end pole for branch-offs RKK....18
10. RKK pole equipment 19
11. Footing elements type Uo and Uk 20
12. Teletechnical composite poles and EKO composite poles 21
13. Stress tables for ADSS 12-72J wires 22
14. Tables of overhangs for ADSS 12-72J wires 23
15. Stress tables for ADSS 96J wiresJ 24
16. Tables of overhangs for ADSS 96J wires 25
17. Stress tables for ADSS 144J wires 26
18. Tables of overhangs for ADSS 144J wires 27
19. Example of mounting a ground teletechnical cable on a pole....28
20. Examples of designed teletechincal line with teletechnical terminal 29

1. Subject and scope of the study.

The catalogue has been prepared for optical fibre overhead telecommunication lines hanged on lightweight composite teletechnical poles with lengths of 7, 8,5 and 10 m, and EKO composite electricity poles with lengths of 9 and 10,5 m, to be used throughout the country.

The study adopts single-mode external self-supporting ADSS 12J 4144J fiber optic cables, completely dielectric with a light multi-tube design, resistant to UV rays.

The study was based on the company standard ZN-96: TPSA 004 and PN-E-05100-1:1998.

All presented solutions are intended to be used throughout the country in all climatic zones. The presented silhouettes of the poles take into account the selection of the structure of footing elements for medium and weak soil.

The album is intended for designers, contractors and operators of telecommunication lines.

2. Pole markings due to their function in the line:

P - through-pole

N - corner pole

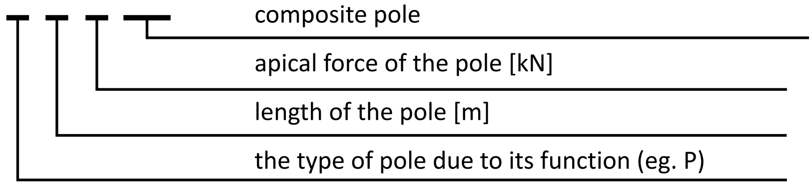
K - end pole

KK - dead-end pole

RKK - dead-end pole for branch-offs

3. Pole markings due to the used solution:

☐-☐/☐/EKO



Example: P-8,5/0,7/EKO - through-pole - length 8,5 m/ apical force 0,7 kN/ composite pole

4. Design principles

The assortment of poles, fiber optic cables and accessories adopted in the catalogue allows for their proper selection, depending on climatic and terrain conditions occurring on the route of the designed line

In order to select these elements correctly, it is necessary to determine:

-climate zone,
- type of fiber optic cable (with the required amount of fibers),
- span length (accordingly to cable overhang) and appropriate cable tension
- type (pole type) and height of the poles,
- ground conditions

Based on the above arrangements, the appropriate pole stands should be selected from the album cards contained in this catalog

5. Line types, span widths, stresses and maximum tensile strength

The study uses fiber optic cables, whose technical parameters are presented in Table 1.

Table 1. Technical data of fiber optic cables.

No.	Cable type	Computing breaking force (RTS) [kN]	Cable diameter [mm]	Cable weight [kg/km]	Cable cross section [mm]	Young's module [Gpa]	Coefficient of thermal expansion
1	MADC 2J	1,8	3,5	13	9,6	13,3	3,4
2	ADSS-12J	6,3	11,2	95	98,5	3,9	22
3	ADSS-24J	6,3	11,2	95	98,5	3,9	22
4	ADSS-36J	6,3	11,2	95	98,5	3,9	22
5	ADSS-48J	6,3	11,2	95	98,5	3,9	22
6	ADSS-72J	6,3	11,2	95	98,5	3,9	22
7	ADSS-96J	6,3	12,8	120	128,6	4,1	24
8	ADSS-144J	8,4	14,7	175	169,6	4,2	28

Table no. 2 presents the basic stress accepted for the fiber optic cables mentioned above and the calculated on their basis tensile stress for span lengths up to 50 m, which are selected in accordance with Table no. 8 of the PN-E-05100-1:1998 standard. In order to facilitate the selection of poles of appropriate strength, Table 2 assumes 3 types of optical fibre lines (LT1, LT2, LT3), depending on the cross-section of the cable and the assumed stress and span length up to 50 m.

Table 2. Basic stresses and tensile strength in fibre-optic overhead cables for span up to 50 m

No.	Cable type	Cross-section [mm]	Basic stress [MPa]	Tensile strength [daN]	Line type
1	ADSS-12J	98,5	11	108	TL1
2	ADSS-24J				
3	ADSS-36J				
4	ADSS-48J				
5	ADSS-72J				
6	ADSS-96J	128,6	8	102	TL2
7	ADSS-144J	169,6		135	TL3

The cable tensions have been selected in such a way as to avoid the possibility of cable vibrations. The basic stress meets the requirements of all levels of restrictions at crossings with all network, rail and road infrastructure.

Table no. 3 shows the unit load of the wires with wind and rime in each climatic zone and the mounting height of the wires up to 10 m.

Table 3. Unit load of the wires with wind and rime in [daN] for 1m.

No.	Cable type	Cable type	Wire cross-section	Wind load		Weight of the cable with rime			
				Climate zone					
				W I	W II	SI	SIa	SII	SIIa
			[mm^2]	daN/m					
1	ADSS-12J	TL1	98,5	0,484	0,574	0,676	0,676	0,967	0,967
2	ADSS-24J								
3	ADSS-36J								
4	ADSS-48J								
5	ADSS-72J								
6	ADSS-96J	TL2	128,6	0,553	0,656	0,745	1,057	1,057	1,469
7	ADSS-144J	TL3	169,6	0,577	0,684	0,851	1,189	1,189	1,601

6. Hanging of the cables

To hang cables, use the equipment of leading and certified companies, whose products provide adequate mechanical strength and have appropriate certificates.

7. Teletechnical composite poles and EKO composite poles

In the solutions of the poles according to this album, composite poles of ALUMAST S. A. production were used, which have the Certificate of Factory Production Control. The basic parameters of composite poles are presented on the rating plates. The characteristic data of the above poles are presented in the final part of the album on the connected elements cards.

8. Types of poles - scope of application

Assuming the functions of poles that they perform in the overhead line, in the album their structures have been developed with the use of single composite poles. The silhouettes of the designed poles show their individual applications (functions) with the determination of mechanical parameters, parameters of cable suspension, depth of burial of the poles in medium and weak soil, depending on the adopted footing element for the permissible pole load. The reinforcement drawings of these poles show the mounting dimensions of the equipment, the height of hanging the wires and the materials list below.

9. Foundations for the installation of poles

Determination of geotechnical foundation conditions. Before proceeding with the selection of pole foundations, it is first necessary to assess the subsoil based on soil tests carried out in accordance with the requirements of PN-EN 1997-2 EUROKOD 7: Geotechnical design - Part 2: Identification and investigation of soil. The principles of geotechnical foundation conditions are clearly defined in the Regulation of the Minister of Transport, Construction and Maritime Economy of 25 April 2012 on the determination of geotechnical foundation conditions for building structures.

In accordance with the above, the geotechnical conditions for the foundation of the poles are determined on the basis of:

- current results of geotechnical surveys of the soil.
- analysis of archival data, including analysis and evaluation of existing geotechnical, geological-engineering and hydrogeological documentation
- geodetic observations of behaviour of neighbouring objects
- other data concerning the test substrate and its surroundings.

In accordance with the above mentioned regulations the Regulation establishes geotechnical categories in the geotechnical opinion, depending on the degree of complexity of soil conditions and construction of a building. Depending on their complexity, the soil conditions are subdivided into following subdivisions: simple, complex and complicated, and distinguishes and characterises three geotechnical categories of building. Geotechnical conditions of foundations are defined in the above mentioned Regulation, which defines the scope of the study presented in the form of:

1. geotechnical opinion
2. documentation of soil tests
3. geotechnical project

Geotechnical opinion is prepared for buildings of all geotechnical categories. For objects of the second geotechnical category, it is necessary to additionally prepare soil documentation and geotechnical design. For construction works of the third geotechnical category and in special complex ground conditions of the second category, additional geological-engineering documentation is prepared in accordance with the provisions of the Geological and Mining Law Act. The foundation of teletechnical line poles, due to the predicted simple or complex ground conditions, should be included in the first and second geotechnical category. Footing elements were selected for high, medium and low bearing capacity soils, however in the tables good and medium soils are treated equally. The construction of foundations in soils with very low bearing capacity, especially in the case of silt, peat, cohesive soils in slightly plastic state, dust sands in loose state, should be designed individually.

Table no. 4 presents the basic parameters of the soil - part 1

Soil type	Name of the soil	Soil condition	Markings in accordance to PN-B-02481:1998P	Markings in accordance to PN-EN ISO14688-1: 2006P+A1:2014-02E PN-EN ISO14688-2: 2006P+A1:2014-02E	Generalised soil parameters				
					ϕ	c	γ	C	μ
					°	kN/m^2	kN/m^3	kN/m^3	
High- and medium-bearing capacity soils	gravel	very compacted; compacted; medium compacted	Ż	Gr	37	0	18,5	40000	0,55
	all-in aggregate		Po	siSa					
	coarse sands		Pr	Sa, siSa					
	medium sands		Ps	Sa					
	fine sands	very compacted; compacted	Pd	Sa, siSa					
	dusts	very compact; compact; Highly plastic		saSi, saclSi, Si, clSi	20	25	20,0	40000	0,25
	clay		G	saclSi, sasiCl, clSi, siCl					
	loam		I	sasiCl, saCl, siCl, Cl					
	clayey all-in aggregate		Pog	Sasi, saCi, Si, siCi, Ci					
	clayey sands		Pg	siSa, cisa, saSi					

Table no. 4 presents the basic parameters of the soil - part 2

Soil type	Name of the soil	Soil condition	Markings in accordance to PN-B-02481:1998P	Markings in accordance to PN-EN ISO14688-1: 2006P+A1:2014-02E PN-EN ISO14688-2: 2006P+A1:2014-02E	Generalised soil parameters				
					ϕ	c	γ	C	μ
					°	kN/m^2	kN/m^3	kN/m^3	
Low-bearing capacity soil	gravel	loose	Ż	Gr	32	0	17,5	25000	0,45
	all-in aggregate		Po	siSa					
	coarse sands		Pr	Sa, siSa					
	medium sands	very compacted	Pd	Sa, siSa					
	fine sands	plastic		saSi, saclSi, Si, clSi	15	20	19,0	42500	0,30
	dusts		G	saclSi, sasiCl, clSi, siCl					
	clay		I	sasiCl, saCl, siCl, Cl					
	loam		Pog	Sasi, saCi, Si, siCi, Ci					
	clayey aggregate		Pg	siSa, cisa, Sasi					
Very low- bearing capacity soil	fine sands	loose	Pd	Sa, siSa	25	0	15,0	10000	0,35
	silty sands		P_{Π}	Sa, siSa					
	dusts	slightly plastic		saSi, saclSi, Si, clSi	10	5	18,0	5000	0,10
	clay		G	saclSi, sasiCl, clSi, siCl					
	loam		I	sasiCl, saCl, siCl, Cl					
	clayey all-in aggregate		Pog	Sasi, saCi, Si, siCi, Ci					
	clayey sands		Pg	siSa, cisa, Sasi					

ϕ - angle of internal friction in degrees
c - cohesion
γ - volumetric weight
C- soil susceptibility module
μ - coefficient of friction of the soil against the concrete foundation

10. Types and constructions of footing elements

Pole's footing elements were selected on the basis of geotechnical calculations in accordance with PN-EN 1997-1 EUROKOD 7: Geotechnical design - Part 1: General principles.

The album contains the following solutions for the footing elements:

Uo footing element - without additional footing elements; the pole is inserted into the drilled hole f 30 cm which is than filled up with subsoil.

Uk footing element - foundation with the use of resin mass; the pole is inserted into the drilled hole f 50 cm which is than filled with resin mass.

11. Making of foundations for the poles

All works connected with making a foundation must be carried out according to the rules specified below and in accordance with the requirements of PN-EN 1990 EUROKOD 0: Basics of structure design, PN-EN 1997-1 EUROKOD 7: Geotechnical design - Part 1: General principles, PN-B-06050:1999 Geotechnics - Earthworks - General requirements.

Before starting excavations, make sure that there are no underground devices in the area of the planned excavation. With the user's consent, any possible collisions must be eliminated or existing units must be secured. Excavation should precede the removal of subsoil to a depth of 20 cm, on an area with side dimensions increased by about 1 m from the outline of the excavation. To install poles with footing elements Uo and Uk it is planned to drill holes in the ground with a diameter of f 0. 3 m and f 0. 5 m. For Uo type foundations, the load-bearing capacity of the foundation is determined by careful backfilling of excavations, which should be carried out in 20-30 cm thick layers with simultaneous soil compaction, enabling the achievement of the maximum level of compaction for a given soil type. Pouring water on the backfilled soil before compaction results in better soil compaction. After backfilling the excavation, at the perimeter of the pole, spread the native soil (set aside from the outer layer) up to 15 cm above the ground, with a slope outside to the outline of the backfilled excavation.

12. Grounding and protection against electric shock

Due to the absence of conductive elements in the line (poles, cable and handles made entirely of insulating materials), there is no need for protective and lightning protection earthing.

13. Line assembly instructions

General comments

The solutions presented in the album allow for the implementation of overhead teletechnical lines with span lengths of up to 50 m on poles with usable forces (maximum breaking force applied at the top of the pole that this pole will withstand) of up to 2,5 kN.

Before positioning the pole in the excavation, attach the equipment for hanging the wires. The armed pole should be placed in a excavation or in a hole drilled by means of a crane. Fill in the excavation in accordance with point. 8. from technical description. Carry out the cable routing using mounting rollers hung on poles. The connection cable must be installed after tensioning the main line. Transportation of elements, construction and installation of lines must be carried out in accordance with the rules of general construction and with the detailed instructions issued by the manufacturers of poles, structures, equipment, construction and assembly equipment.

Line assembly technology

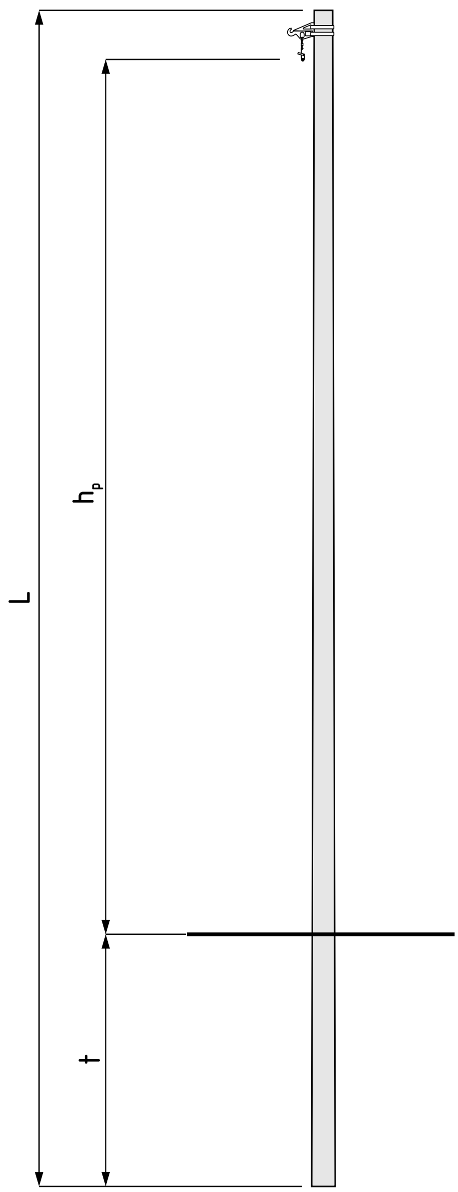
Telecommunication cable bundle extends in one extraction section, which may contain one corner pole with a 90 ° bend angle or two poles with a 120 ° bend angle. Prior to tensioning the wiring harnesses using the prewire, assembly rollers are hung on the hooks. The correct insertion of telecommunication wiring harnesses into end pole and section support poles, after having been connected to a primary cable at least 10 mm in diameter by means of a swivel and a sheet, requires the positioning of a drum on a rack with brake at a distance of approximately 20 m from the pole. During stretching it is necessary to make sure that the telecommunication cables do not touch the ground, and also do not rub against terrain obstacles. The stretching can be terminated when the end of the telecommunication cable bundle is pulled through the end pole and section support poles. The installation of the anchor clamp can be then proceeded. After hanging the anchor clamp on the pole, move to the site next to the drum which includes wires. Before starting to stretch a bundle of telecommunication cables it is necessary to install a handle to stretch a bundle of teletechnical cables, which is connected to the pole by means of a device stretching the wires and a dynamometer. Next, the process of adjusting the tension of the bundle of telecommunication cables should be started based on the table of tensions. To compensate for overhangs of the resistive section, initial bundle overtension is permitted, but not more than 20% of the tensile strength. The tension adjustment process can also be carried out on the basis of the tables of overhangs and using measuring rod. For new wires, the following expansion stresses must be applied - select a tension or overhang for a temperature lower by 5°. Once the proper tension of the telecommunication cable bundle has been achieved, a second anchor clamp can be attached. Now you can start to replace the assembly rollers with through or through-corner holder. After installing one track in such a way, it is possible to start assembling the next tracks.

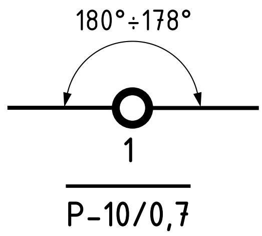
The other components are then assembled, such as connections, cable reserves and branch boxes. When installing the steel tape securing the structures and accessories to the pole, use the instructions given in the album card of related elements included in chapter II of this study.

Running lines close to trees and forest felling

According to N SEP-E-003 recommendations, overhead power lines made with insulated wires led through the forest and near trees should be designed and implemented taking into account the requirements of PN-E-05100-1: 1998 and in accordance with the following recommendations: existing forest fellings, fire protection zones or forest roads should be used when guiding the line through the forest and the distance of conductors of the telecommunication line from tree trunks and branches should not be less than 0. 5 m.

Composite through pole
P-☐/☐



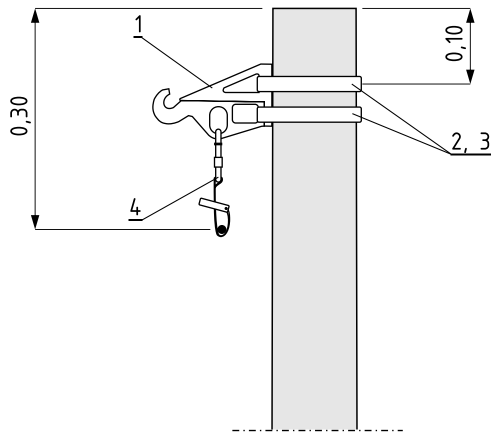


Pn - required pole apical force 0,7 kN

h_p - hanging height of cables for telecommunication line

t - depth of burial of the pole

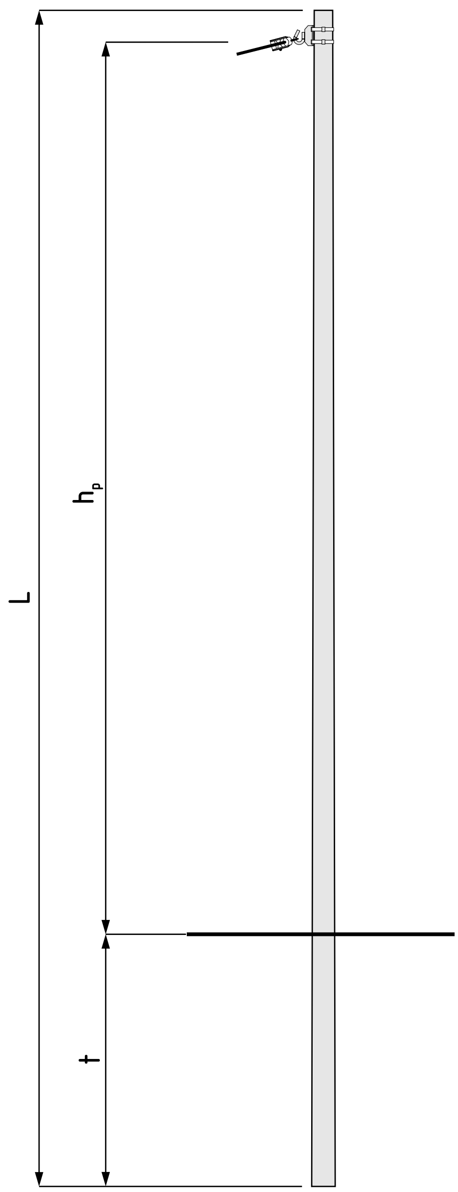
Pole type	Perch type	Quantity [pcs.]	Permissible pole load Pu [daN]	Pole length [m]	Footing element type	Burial depth t for medium/weak soil [m]	Hanging height hp of wires for medium/ weak soil [m]	COMMENTS
P - 7/0,3	0,3/Dw=110	1	30	7,0	Uo	1,2	5,6	Through poles for wires type MADC 2J max. span up to 30 m
P - 8,5/0,3	0,3/Dw=120			8,5			7,1	
P - 10/0,3				10,0			8,6	
P - 7/0,7	0,7/Dw=110	1	70	7,0	Uo	1,5 / 1,7	5,2 / 5,0	Through poles for line: TL1 TL2 TL3
P - 8,5/0,7	0,7/Dw=120			8,5		1,7 / 1,9	6,5 / 6,3	
P - 10/0,7	0,7/Dw=140			10,0		2,0 / 2,1	7,7 / 7,6	

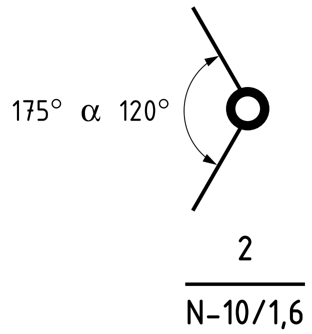


Material list

No.	Specification	Unit	Quantity	Comments
4	Pass-through holder	pcs.	1	
3	Steel tape clasps	pcs.	2	
2	Steel tape 20x0,7	m	1,6	for fixing pos. no. 1 - 2x double
1	Aluminium pole bracket PS-150	pcs.	1	

Composite corner pole N-☐/☐





Corner pole selection depending on the line type:

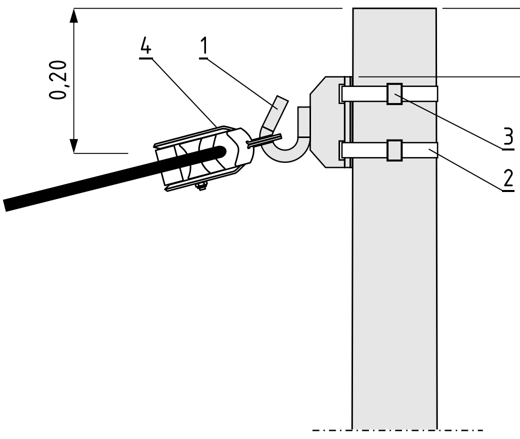
Wire/line type	α=150°		α=120°	
	Climate zone			
	WI	WII	WI	WII
	Pn= [kN]			
MADC 2J	0,7			
TL1	1,6			
TL2				
TL3				

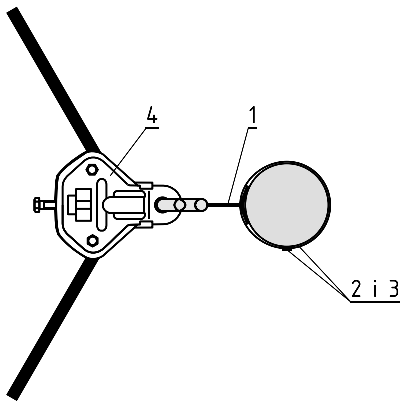
Pn – required pole apical force

h_p – hanging height of cables for telecommunication line

t – depth of burial of the pole

Pole type	Perch type	Quantity [pcs.]	Permissible pole load Pu [daN]	Pole length [m]	Footing element type	Burial depth t for medium/weak soil [m]	Hanging height hp of wires for medium/weak soil [m]	COMMENTS
N – 7/0,7	0,7/Dw=110	1	70	7,0	Uo	1,5 / 1,7	5,2 / 5,0	Corner poles for wires type MADC 2J max. span up to 30 m
N – 8,5/0,7	0,7/Dw=120			8,5		1,7 / 1,9	6,5 / 6,3	
N – 10/0,7	0,7/Dw=140			10,0		2,0 / 2,1	7,7 / 7,6	
N – 7/1,6	1,6/Dw=120	1	160	7,0	Uk	1,4 / 1,6	5,4 / 5,2	Corner poles for lines: TL1, TL2, TL3 Uk – resin, composite footage element to bury
N – 8,5/1,6				8,5		1,6 / 1,8	6,7 / 6,5	
N – 10/1,6	1,6/Dw=140			10,0		1,8 / 2,0	8,0/ 7,8	





Material list

No.	Specification	Unit	Quantity	Comments
4	Corner holder	pcs.	1	
3	Steel tape clasps	pcs.	2	
2	Steel tape 20x0,7 m	m	1,6	for fixing position no. 1 - 2x double
1	Slings with hooks M16	pcs.	1	

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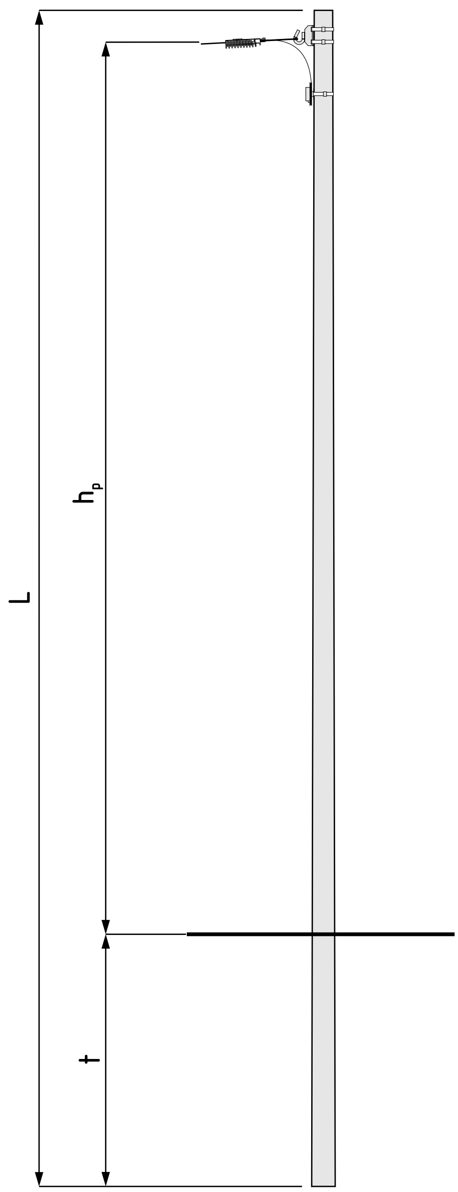


3

K-10/1,6

Corner pole selection depending on the line type:

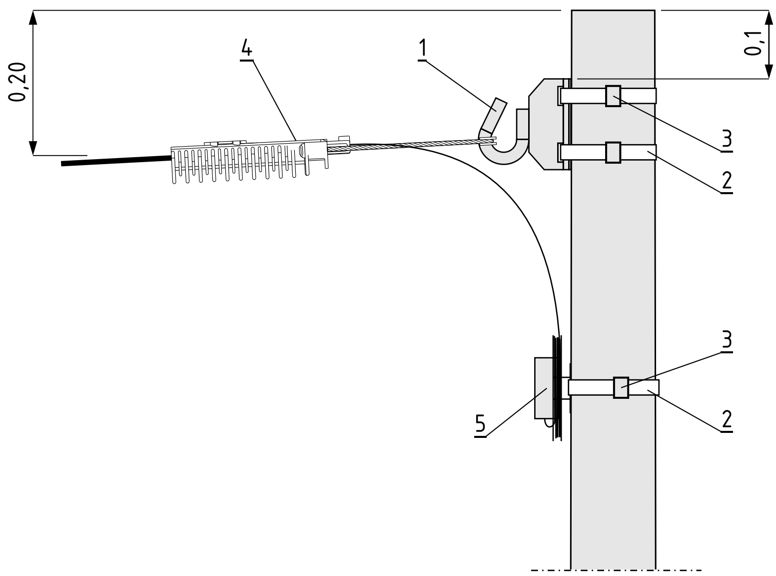
Line type	Climate zone WI	Climate zone WII
	Pn= [kN]	
cable MADC 2J	0,7	
TL1	1,6	
TL2		
TL3		

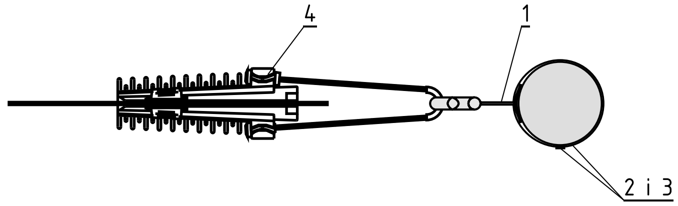
Pn - required pole apical force

h_p - hanging height of cables for telecommunication line

t - depth of burial of the pole

Pole type	Perch type	Quantity [pcs.]	Permissible pole load Pu [daN]	Pole length [m]	Footing element type	Burial depth t for medium/weak soil [m]	Hanging height hp of wires for medium/ weak soil [m]	COMMENTS
K - 7/0,7	0,7/Dw=110	1	70	7,0	Uo	1,5 / 1,7	5,2 / 5,0	Corner poles for wires MADC 2J type max. span up to 30 m.
K - 8,5/0,7	0,7/Dw=120			8,5		1,7 / 1,9	6,5 / 6,3	
K - 10/0,7	0,7/Dw=140			10,0		2,0 / 2,1	7,7 / 7,6	
K - 7/1,6	1,6/Dw=120	1	160	7,0	Uk	1,5 / 1,7	5,3 / 5,1	End poles for lines: TL1, TL2, TL3 Uk- resin, composite pole to bury
K - 8,5/1,6				8,5		1,7 / 1,9	6,6 / 6,4	
K - 10/1,6	1,6/Dw=140			10,0		2,0 / 2,1	7,8 / 7,7	

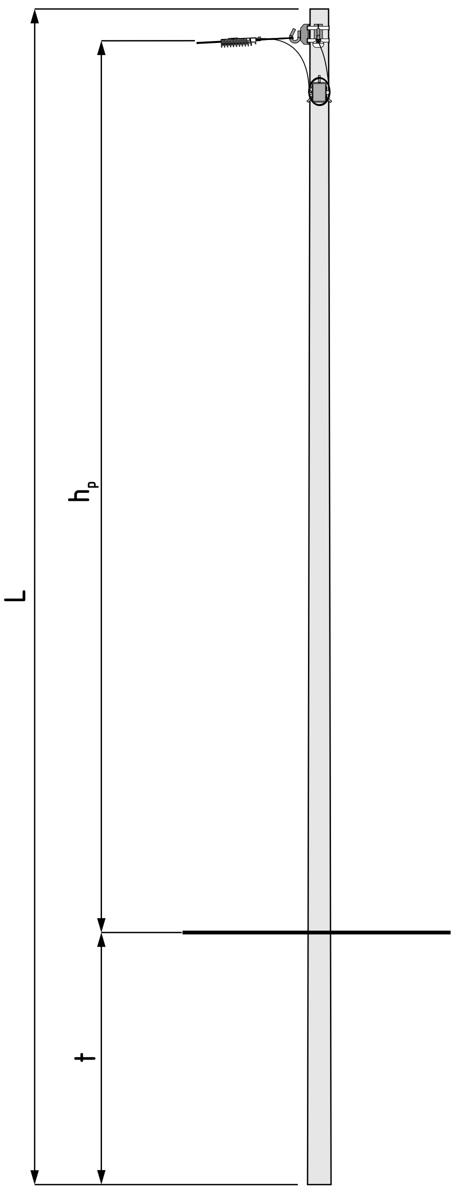


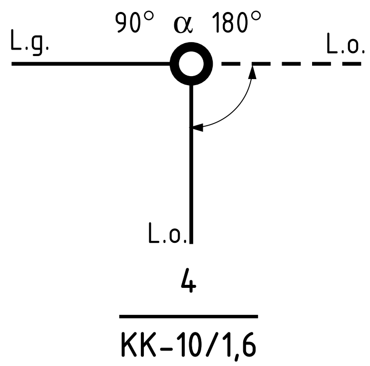


Material list

No.	Specification	Unit	Quantity	Comments
5	Distribution box with triple arm installation rack pcs.	pcs.	1	
4	Anchor clamp	pcs.	1	
3	Steel tape clasps	pcs.	3	
2	Steel tape 20x0,7	m	2,0	for fixing pos. no. 1 and 5
1	Slings with hooks M16	pcs.	1	

Composite dead-end pole
KK-☐/☐





Selection of dead-end pole depending on the type of line:

Main line type [l.g.]	Required apical force Pn of the pole depending on angle α in [kN]					
	Branch line type					
	TL1	TL2	TL3	TL1	TL2	TL3
	180°÷120°			120°÷90°		
TL1	1,6			2,5		
TL2						
TL3	2,5					

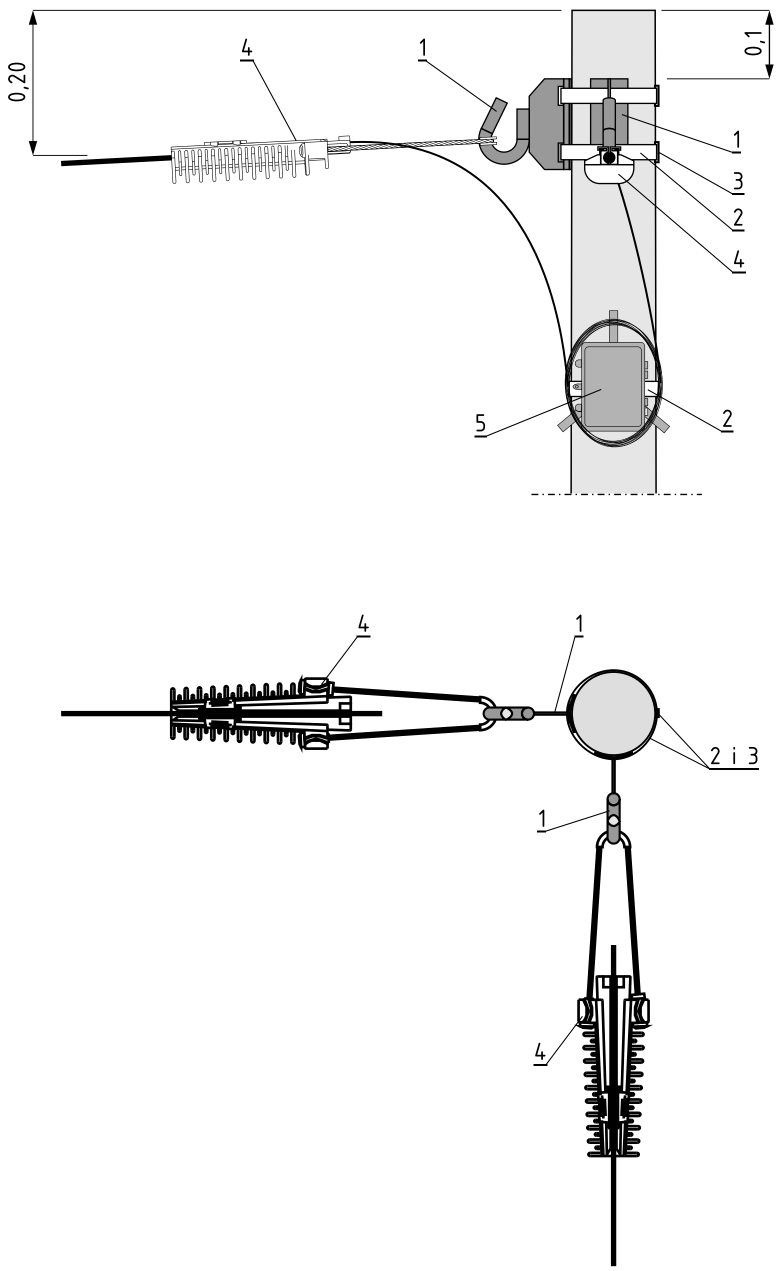
h_p - hanging height of cables for telecommunication line

t - depth of burial of the pole

Pole type	Perch type	Quantity [pcs.]	Permissible pole load Pu [daN]	Pole length [m]	Footing element type	Burial depth t for medium/weak soil [m]	Hanging height hp of wires for medium/ weak soil [m]	COMMENTS
KK - 7/1,6	1,6/Dw=120	1	160	7,0	Uk	1,5 / 1,7	5,3 / 5,1	Uk - resin, composite footing element to bury telecommunication poles
KK - 8,5/1,6				8,5		1,7 / 1,9	6,6 / 6,4	
KK - 10/1,6	1,6/Dw=140			10,0		2,0 / 2,1	7,8 / 7,7	
RKK-7/2,5	2,5/Dw=150		250	7,0		1,8 / 2,0	5,0 / 4,8	
RKK-8,5/2,5	2,5/Dw=200			8,5		1,9 / 2,0	6,4 / 6,3	
RKK-10/2,5				10,0		2,0 / 2,1	7,8 / 7,7	
KK - 9/2,5	2,5/Dw=150			9,0		2,0 / 2,1	6,8 / 6,7	Uk - resin, composite footing element to bury EKO electricity poles
KK - 10,5/2,5				10,5		2,0 / 2,1	8,3 / 8,2	

APG projekt

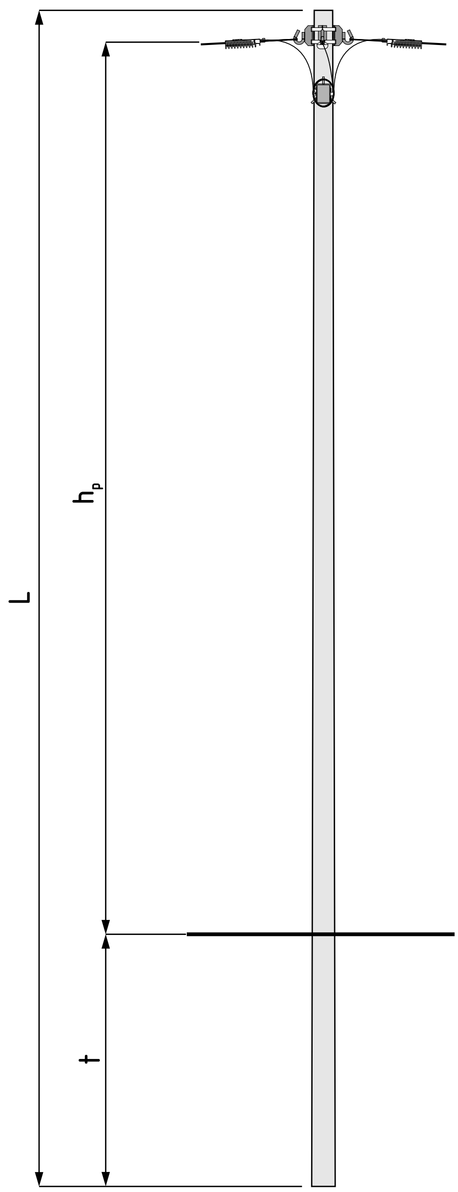
alumast S.A.

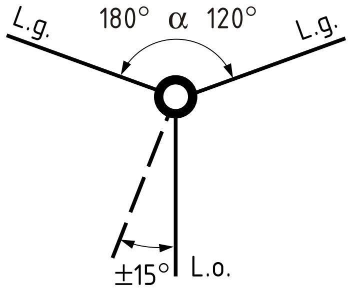


Material list

5	Distribution box with triple arm installation rack	pcs.	1	
4	Anchor clamp	pcs.	2	
3	Steel tape clasps	pcs.	3	
2	Steel tape 20x0,7	m	3	for fixing pos. no. 1 and 5
1	Slings with hooks M16	pcs.	2	
No.	Specification	Unit	Quantity	Comments

Composite dead-end pole for branch-offs RKK-☐/2,5





5
RKK-9/2,5

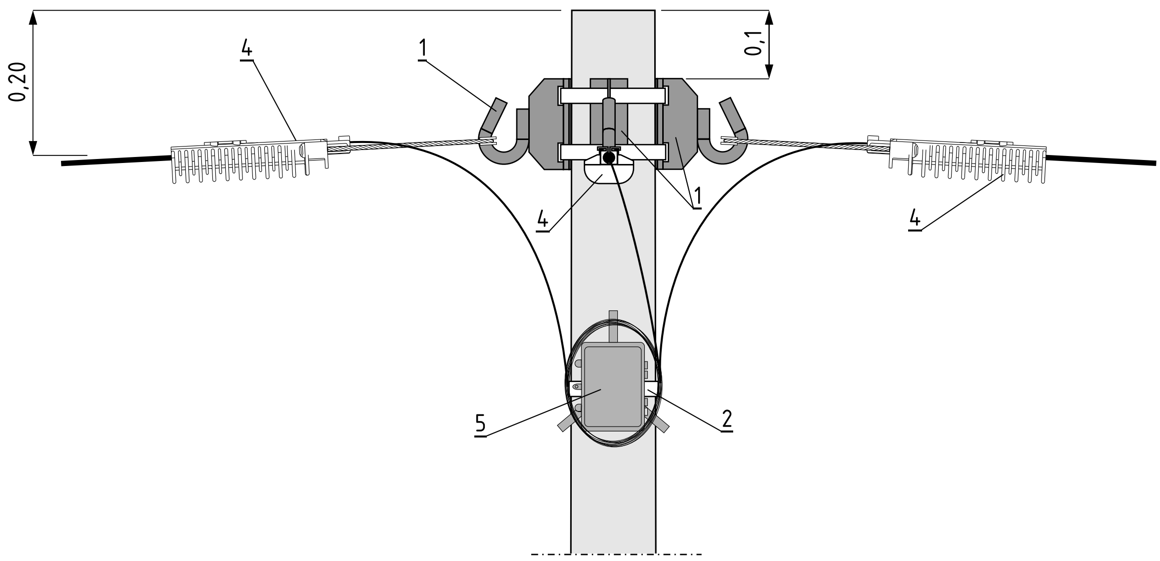
Selection of dead-end pole depending on the type of line:

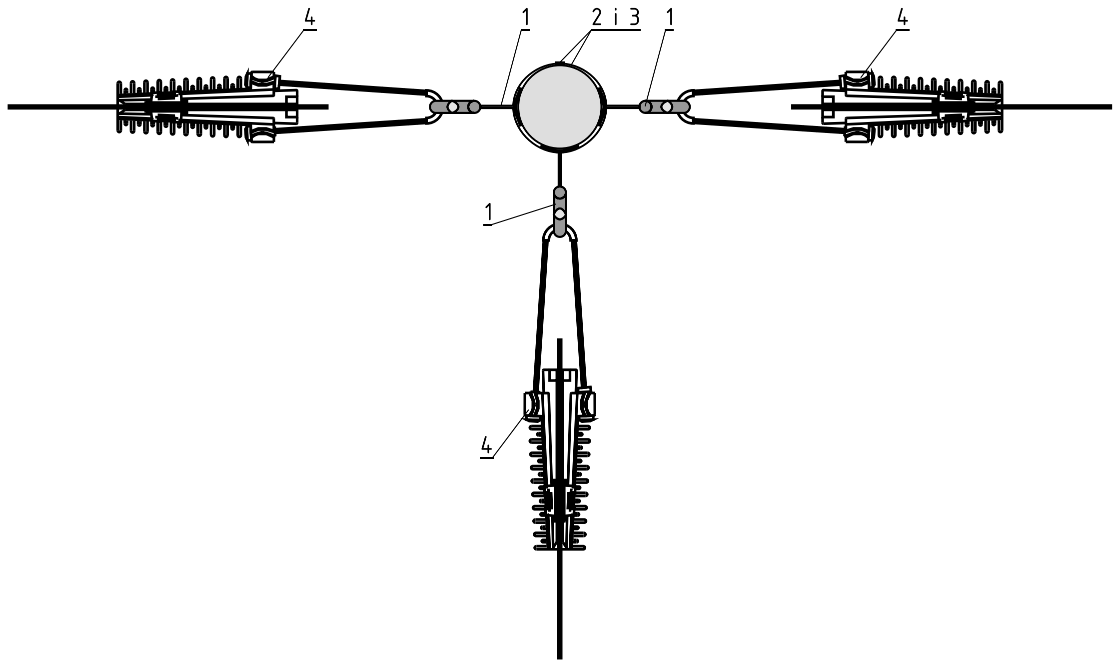
Main line type [l.g.]	Pn – required pole apical force [kN]		
	Branch line type		
	TL1	TL2	TL3
TL1	2,5		
TL2			
TL3			

h_p – hanging height of cables for telecommunication line

t – depth of burial of the pole

Pole type	Perch type	Quantity [pcs.]	Permissible pole load Pu [daN]	Pole length [m]	Footing element type	Burial depth t for medium/weak soil [m]	Hanging height hp of wires for medium/ weak soil [m]	COMMENTS
RKK-7/2,5	2,5/Dw=150	1	250	7,0	Uk	1,8 / 2,0	5,0 / 4,8	Uk – resin, composite footing element to bury telecommunication poles
RKK-8,5/2,5	2,5/Dw=200			8,5		1,9 / 2,0	6,4 / 6,3	
RKK-10/2,5				10,0		2,0 / 2,1	7,8 / 7,7	
RKK-9/2,5/EKO	2,5/Dw=150			9,0		2,0 / 2,1	6,8 / 6,7	Uk – composite resin footing element to bury EKO electricity pole
RKK-10,5/2,5/EKO				10,5		2,0 / 2,1	8,3 / 8,2	

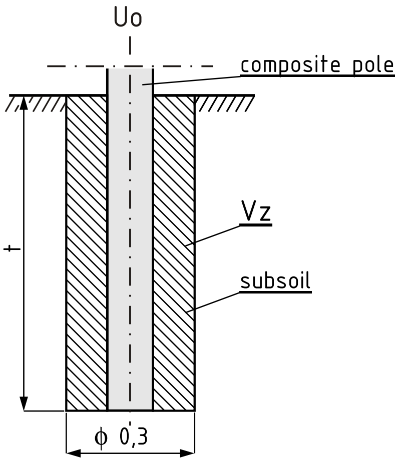




Material list

No.	Specification	Unit	Quantity	Comments
5	Distribution box with triple arm installation rack	pcs.	1	
4	Anchor clamp	pcs	3	
3	Steel tape clasps	pcs	3	
2	Steel tape 20x0,7	m	3	for fixing pos. no. 1 and 5
1	Slings with hooks M16	pcs	3	

Footing element Uo - Structure of footing element in a drilled hole filled with subsoil

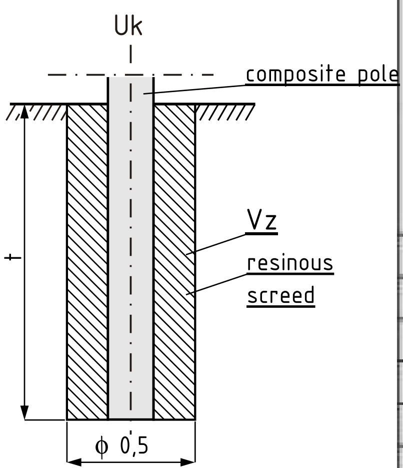


Footing elements Uo for through poles for TL1, TL2, TL3 and strong MADC 2J lines							
Drilling depth "t" [m]	Excavation volume for ϕ=0,3m	Volume of the underground part of the pole Vs [m 3] for the pole length L [m] and the usable force 0. 7 [kN]			Filling of the excavation with subsoil Vz [m 3] for pole length L [m] and usable force 0.7 [kN]		
		7/0,7	8,5/0,7	10/0,7	7/0,7	8,5/0,7	10/0,7
1,4	0,126	0,017	0,020	0,027	0,109	0,106	0,099
1,5	0,135	0,018	0,022	0,029	0,117	0,113	0,106
1,6	0,144	0,019	0,023	0,031	0,125	0,121	0,113
1,7	0,153	0,021	0,024	0,033	0,132	0,129	0,120
1,8	0,162	0,022	0,026	0,035	0,140	0,136	0,127
1,9	0,171	0,023	0,027	0,037	0,148	0,144	0,134
2,0	0,180	0,024	0,029	0,039	0,156	0,151	0,141
2,1	0,189	0,025	0,030	0,041	0,164	0,159	0,148
2,2	0,198	0,027	0,032	0,043	0,171	0,166	0,155

Footing element Uo for through pole for lines MADC 2J							
Drilling depth "t" [m]	Excavation volume for ϕ =0,3m	Volume of the underground part of the pole Vs [m3] for the pole length L [m] and the usable force 0. 7 [kN]			Filling of the excavation with subsoil Vz [m3] for pole length L[m] and usable force 0.7 [kN]		
		7/0,3	8,5/0,3	10/0,3	7/0,3	8,5/0,3	10/0,7
1,2	0,108	0,015	0,017	0,017	0,093	0,091	0,091

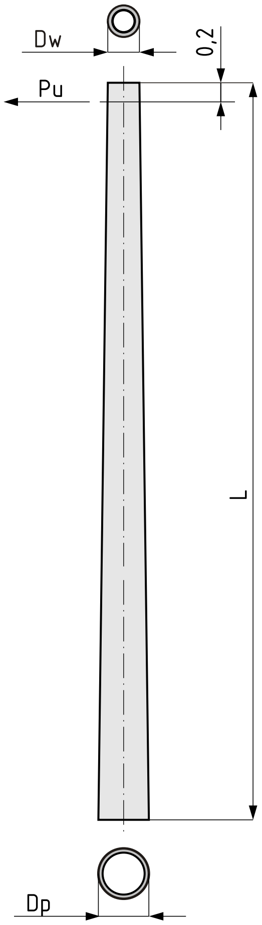
Footing element Uk - Structure of footing element in a drilled hole filled with resin material

Resin screed is a two-component resin compound.
After mixing and pouring into the hole between the pole and the ground it grows (expands) for about 5 minutes, tightly filling the space creating a permanent fixing resistant to humidity and changing environmental conditions.



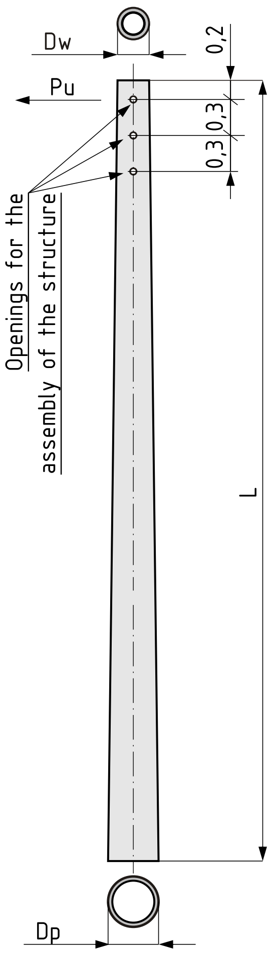
Footing element Uk for function poles (strong) for TL1, TL2, TL3 lines					
Drilling depth "t" [m	Excavation volume for ϕ =0,5m	Volume of the underground part of the pole Vs [m 3] for the pole length L [m] and the usable force Pu [kN]		Refill of the excavation with resin material Vz [m 3] for pole length L[m] and usable force Pu [kN].	
		7/1,6 8,5/1,6	10/1,6 9/2,5 10,5/2,5	7/1,6 8,5/1,6	10/1,6 9/2,5 10,5/2,5
1,4	0,350	0,038	0,052	0,312	0,298
1,5	0,375	0,041	0,056	0,334	0,319
1,6	0,400	0,044	0,060	0,356	0,340
1,7	0,425	0,046	0,063	0,379	0,362
1,8	0,450	0,049	0,067	0,401	0,383
1,9	0,475	0,052	0,071	0,423	0,404
2,0	0,500	0,054	0,074	0,446	0,426
2,1	0,525	0,057	0,078	0,468	0,447
2,2	0,550	0,060	0,082	0,490	0,468

Composite telecommunication poles



No.	Pole type	Apical force Pu [kN]	Dimensions L [m]	Dw [mm]	Dp [mm]	weight [kg]
1	7/0,3	0,3	7,0	110	140	12
2	8,5/0,3	0,3	8,5	120	165	16,5
3	10/0,3	0,3	10,0	120	165	26,6
4	7/0,7	0,7	7,0	110	140	15,6
5	8,5/0,7	0,7	8,5	120	165	28,9
6	10/0,7	0,7	10,0	140	193	31,1
7	7/1,6	1,6	7,0	120	165	24
8	8,5/1,6	1,6	8,5	120	165	47,1
9	10/1,6	1,6	10,0	140	193	54,5
10	7/2,5	2,5	7,0	150	200	23,2
11	8,5/2,5	2,5	8,5	200	240	34,9
12	10/2,5	2,5	10,0	200	240	49,3

Composite poles EKO



Round energy composite poles – type EKO

No.	Pole type	Apical force Pu [kN]	Dimensions L [m]	Dw [mm]	Dp [mm]	Weight [kg]	Marking colour
1	Eko 9/2,5	2,5	9	150	193	60	white
2	Eko 9/4,5	4,5	9	150	193	80	blue
3	Eko 9/6	6	9	173	220	80	black
4	Eko 10,5/2,5	2,5	10,5	150	193	70	white
5	Eko 10,5/4,5	4,5	10,5	173	250	100	blue
6	Eko 10,5/6	6	10,5	173	250	100	black
7	Eko 12/2,5	2,5	12	173	220	100	white
8	Eko 12/4,5	4,5	12	173	250	120	blue
9	Eko 12/6	6	12	218	250	120	black

Breakthrough span a = 16,624 [m]				Wire type: ADSS 12-72J			Basic stress			σ = 11 [MPa]	
Coefficient of thermal elongation			α = 0,000022 [1/°C]		Coefficient of elasticity elongation			β = 0,0039 [MPa]		**Stress table**	
Wire cross section d = 98,5 [mm2]				Cable diameter s = 11,2 [mm2]				**Rime load zone SI**			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	11,00	10,94	10,89	10,86	10,80	10,75	10,69	10,63	10,52	10,90	10,92
10	11,00	10,94	10,89	10,86	10,80	10,75	10,69	10,63	10,52	10,93	11,03
15	11,00	10,94	10,89	10,86	10,80	10,75	10,69	10,63	10,52	10,98	11,20
20	10,95	10,89	10,84	10,81	10,75	10,70	10,64	10,58	10,47	11,00	11,37
25	10,86	10,80	10,75	10,72	10,66	10,60	10,55	10,49	10,38	11,00	11,56
30	10,75	10,69	10,63	10,60	10,55	10,49	10,44	10,38	10,27	11,00	11,76
35	10,61	10,56	10,50	10,47	10,42	10,36	10,30	10,25	10,14	11,00	11,98
40	10,46	10,40	10,35	10,32	10,26	10,21	10,15	10,10	9,98	11,00	12,21
45	10,29	10,23	10,18	10,15	10,09	10,03	9,98	9,92	9,81	11,00	12,44
50	10,10	10,04	9,98	9,96	9,90	9,84	9,79	9,73	9,62	11,00	12,68
55	9,88	9,83	9,77	9,74	9,69	9,63	9,57	9,52	9,41	11,00	12,91
60	9,65	9,60	9,54	9,51	9,45	9,40	9,34	9,29	9,18	11,00	13,14

Breakthrough span a = 11,573 [m]				Wire type: ADSS 12-72J			Basic stress			σ = 11 [MPa]	
Coefficient of thermal elongation		α = 0,000022 [1/°C]			Coefficient of elasticity elongation		β = 0,0039 [MPa]			**Stress table**	
Wire cross section d = 98,5 [mm2]				Cable diameter s = 11,2 [mm2]				**Rime load zone SIa and SII**			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	11,00	10,94	10,89	10,86	10,80	10,75	10,69	10,63	10,52	10,91	10,96
10	11,00	10,94	10,89	10,86	10,80	10,75	10,69	10,63	10,52	10,97	11,18
15	10,92	10,87	10,81	10,78	10,73	10,67	10,61	10,56	10,44	11,00	11,45
20	10,78	10,72	10,66	10,64	10,58	10,52	10,47	10,41	10,30	11,00	11,74
25	10,59	10,53	10,47	10,45	10,39	10,33	10,28	10,22	10,11	11,00	12,07
30	10,36	10,30	10,24	10,21	10,16	10,10	10,05	9,99	9,88	11,00	12,41
35	10,08	10,03	9,97	9,94	9,89	9,83	9,77	9,72	9,60	11,00	12,76
40	9,77	9,71	9,66	9,63	9,57	9,52	9,46	9,40	9,29	11,00	13,11
45	9,41	9,36	9,30	9,27	9,22	9,16	9,10	9,05	8,94	11,00	13,45
50	9,02	8,96	8,91	8,88	8,82	8,76	8,71	8,65	8,54	11,00	13,78
55	8,58	8,52	8,47	8,44	8,38	8,33	8,27	8,22	8,10	11,00	14,10
60	8,10	8,05	7,99	7,97	7,91	7,85	7,80	7,74	7,63	11,00	14,41

Breakthrough span a = 8,095 [m]				Wire type: ADSS 12-72J			Basic stress			σ = 11 [MPa]	
Coefficient of thermal elongation			α = 0,000022 [1/°C]		Coefficient of elasticity elongation			β = 0,0039 [MPa]		**Stress table**	
Wire cross section d = 98,5 [mm2]				Cable diameter s = 11,2 [mm2]				**Rime load zone SIIa**			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	11,00	10,94	10,89	10,86	10,80	10,75	10,69	10,63	10,52	10,93	11,05
10	10,94	10,88	10,83	10,80	10,74	10,69	10,63	10,57	10,46	11,00	11,43
15	10,73	10,67	10,61	10,58	10,53	10,47	10,42	10,36	10,25	11,00	11,86
20	10,42	10,37	10,31	10,28	10,23	10,17	10,11	10,06	9,94	11,00	12,36
25	10,04	9,98	9,93	9,90	9,84	9,78	9,73	9,67	9,56	11,00	12,87
30	9,57	9,51	9,45	9,42	9,37	9,31	9,26	9,20	9,09	11,00	13,38
35	9,01	8,95	8,90	8,87	8,81	8,76	8,70	8,64	8,53	11,00	13,86
40	8,37	8,31	8,26	8,23	8,17	8,12	8,06	8,00	7,89	11,00	14,33
45	7,64	7,59	7,53	7,50	7,45	7,39	7,34	7,28	7,17	11,00	14,76
50	6,84	6,78	6,73	6,70	6,65	6,59	6,53	6,48	6,37	11,00	15,17
55	5,96	5,91	5,85	5,82	5,77	5,72	5,66	5,61	5,50	11,00	15,55
60	5,02	4,97	4,92	4,89	4,84	4,79	4,73	4,68	4,57	11,00	15,90

Breakthrough span a = 16,624 [m]				Wire type: ADSS 12-72J			Basic stress		σ = 11 [MPa]	
Coefficient of thermal elongation			α = 0,000022 [1/°C]	Coefficient of elasticity elongation			β = 0,0039 [MPa]		Stress table	
Wire cross section d = 98,5 [mm2]				Cable diameter s = 11,2 [mm2]			Rime load zone SI			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	11,00	10,94	10,89	10,86	10,80	10,75	10,69	10,63	10,52	10,90	10,92
10	11,00	10,94	10,89	10,86	10,80	10,75	10,69	10,63	10,52	10,93	11,03
15	11,00	10,94	10,89	10,86	10,80	10,75	10,69	10,63	10,52	10,98	11,20
20	10,95	10,89	10,84	10,81	10,75	10,70	10,64	10,58	10,47	11,00	11,37
25	10,86	10,80	10,75	10,72	10,66	10,60	10,55	10,49	10,38	11,00	11,56
30	10,75	10,69	10,63	10,60	10,55	10,49	10,44	10,38	10,27	11,00	11,76
35	10,61	10,56	10,50	10,47	10,42	10,36	10,30	10,25	10,14	11,00	11,98
40	10,46	10,40	10,35	10,32	10,26	10,21	10,15	10,10	9,98	11,00	12,21
45	10,29	10,23	10,18	10,15	10,09	10,03	9,98	9,92	9,81	11,00	12,44
50	10,10	10,04	9,98	9,96	9,90	9,84	9,79	9,73	9,62	11,00	12,68
55	9,88	9,83	9,77	9,74	9,69	9,63	9,57	9,52	9,41	11,00	12,91
60	9,65	9,60	9,54	9,51	9,45	9,40	9,34	9,29	9,18	11,00	13,14

Breakthrough span a = 11,573 [m]				Wire type: ADSS 12-72J			Basic stress		σ = 11 [MPa]	
Coefficient of thermal elongation			α = 0,000022 [1/°C]	Coefficient of elasticity elongation			β = 0,0039 [MPa]		Stress table	
Wire cross section d = 98,5 [mm2]				Cable diameter s = 11,2 [mm2]			Rime load zone SIa and SII			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,05
10	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,11	0,21
15	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,25	0,46
20	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,05	0,45	0,80
25	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,70	1,21
30	0,10	0,10	0,10	0,10	0,10	0,11	0,11	0,11	0,11	1,00	1,69
35	0,14	0,14	0,15	0,15	0,15	0,15	0,15	0,15	0,15	1,37	2,24
40	0,19	0,19	0,20	0,20	0,20	0,20	0,20	0,20	0,20	1,78	2,85
45	0,25	0,26	0,26	0,26	0,26	0,26	0,26	0,26	0,27	2,26	3,52
50	0,33	0,33	0,33	0,33	0,34	0,34	0,34	0,34	0,35	2,79	4,24

Breakthrough span a = 8,095 [m]				Wire type: ADSS 12-72J			Basic stress		σ = 11 [MPa]	
Coefficient of thermal elongation			α = 0,000022 [1/°C]	Coefficient of elasticity elongation			β = 0,0039 [MPa]		Stress table	
Wire cross section d = 98,5 [mm2]				Cable diameter s = 11,2 [mm2]			Rime load zone SIIa			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,04	0,08
10	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,16	0,30
15	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,36	0,64
20	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,64	1,09
25	0,07	0,07	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,99	1,64
30	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,12	0,12	1,43	2,27
35	0,16	0,16	0,16	0,16	0,16	0,17	0,17	0,17	0,17	1,95	2,99
40	0,23	0,23	0,23	0,23	0,23	0,23	0,23	0,24	0,24	2,54	3,78
45	0,31	0,32	0,32	0,32	0,32	0,32	0,33	0,33	0,33	3,22	4,64
50	0,43	0,44	0,44	0,44	0,44	0,45	0,45	0,46	0,46	3,98	5,57
55	0,60	0,61	0,61	0,61	0,62	0,63	0,63	0,64	0,65	4,81	6,58
60	0,85	0,86	0,87	0,87	0,88	0,89	0,90	0,91	0,93	5,73	7,65

Breakthrough span a = 15,016 [m]				Wire type: ADSS 96J			Basic stress			σ = 8 [MPa]	
Coefficient of thermal elongation			α = 0.000024 [1/°C]		Coefficient of elasticity elongation		β = 0.0041 [MPa]			Stress table	
Wire cross section d = 128,6 [mm2]				Cable diameter s = 12,8 [mm2]			Rime load zone SI and SIa				
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	8,00	7,94	7,88	7,85	7,80	7,74	7,68	7,62	7,50	7,89	7,93
10	8,00	7,94	7,88	7,85	7,80	7,74	7,68	7,62	7,50	7,94	8,06
15	8,00	7,94	7,88	7,85	7,80	7,74	7,68	7,62	7,50	8,00	8,26
20	7,91	7,85	7,79	7,76	7,70	7,65	7,59	7,53	7,41	8,00	8,44
25	7,79	7,73	7,68	7,65	7,59	7,53	7,47	7,41	7,30	8,00	8,64
30	7,65	7,59	7,53	7,51	7,45	7,39	7,33	7,27	7,15	8,00	8,85
35	7,48	7,43	7,37	7,34	7,28	7,22	7,16	7,11	6,99	8,00	9,07
40	7,29	7,23	7,17	7,15	7,09	7,03	6,97	6,91	6,80	8,00	9,29
45	7,07	7,01	6,96	6,93	6,87	6,81	6,75	6,70	6,58	8,00	9,51
50	6,83	6,77	6,72	6,69	6,63	6,57	6,51	6,46	6,34	8,00	9,72
55	6,57	6,51	6,45	6,42	6,37	6,31	6,25	6,19	6,08	8,00	9,93
60	6,28	6,22	6,16	6,14	6,08	6,02	5,96	5,91	5,79	8,00	10,13

Breakthrough span a = 10,511 [m]				Wire type: ADSS 96J			Basic stress			σ = 8 [MPa]	
Coefficient of thermal elongation			α = 0.000024 [1/°C]		Coefficient of elasticity elongation		β = 0.0041 [MPa]			Stress table	
Wire cross section d = 128,6 [mm2]				Cable diameter s = 12,8 [mm2]			Rime load zone SII and SIIa				
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	8,00	7,94	7,88	7,85	7,80	7,74	7,68	7,62	7,50	7,91	7,98
10	8,00	7,94	7,88	7,85	7,80	7,74	7,68	7,62	7,50	7,99	8,24
15	7,88	7,82	7,76	7,73	7,67	7,62	7,56	7,50	7,38	8,00	8,52
20	7,69	7,64	7,58	7,55	7,49	7,43	7,37	7,31	7,20	8,00	8,83
25	7,46	7,40	7,34	7,31	7,25	7,19	7,14	7,08	6,96	8,00	9,16
30	7,17	7,11	7,05	7,02	6,96	6,90	6,85	6,79	6,67	8,00	9,49
35	6,83	6,77	6,71	6,68	6,62	6,56	6,51	6,45	6,33	8,00	9,81
40	6,43	6,38	6,32	6,29	6,23	6,17	6,11	6,06	5,94	8,00	10,11
45	5,99	5,93	5,88	5,85	5,79	5,73	5,68	5,62	5,50	8,00	10,41
50	5,50	5,45	5,39	5,37	5,30	5,25	5,19	5,14	5,02	8,00	10,68
55	4,98	4,92	4,86	4,83	4,78	4,72	4,66	4,61	4,50	8,00	10,94
60	4,41	4,36	4,31	4,27	4,22	4,17	4,11	4,06	3,95	8,00	11,18

Breakthrough span a = 15,016 [m]				Wire type: ADSS 96J			Basic stress			σ = 8 [MPa]	
Coefficient of thermal elongation			α = 0,000024 [1/°C]		Coefficient of elasticity elongation			β = 0,0041 [MPa]		Stress table	
Wire cross section d = 128,6 [mm2]				Cable diameter s = 12,8 [mm2]				Rime load zone SI and SIa			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	8,00	7,94	7,88	7,85	7,80	7,74	7,68	7,62	7,50	7,89	7,93
10	8,00	7,94	7,88	7,85	7,80	7,74	7,68	7,62	7,50	7,94	8,06
15	8,00	7,94	7,88	7,85	7,80	7,74	7,68	7,62	7,50	8,00	8,26
20	7,91	7,85	7,79	7,76	7,70	7,65	7,59	7,53	7,41	8,00	8,44
25	7,79	7,73	7,68	7,65	7,59	7,53	7,47	7,41	7,30	8,00	8,64
30	7,65	7,59	7,53	7,51	7,45	7,39	7,33	7,27	7,15	8,00	8,85
35	7,48	7,43	7,37	7,34	7,28	7,22	7,16	7,11	6,99	8,00	9,07
40	7,29	7,23	7,17	7,15	7,09	7,03	6,97	6,91	6,80	8,00	9,29
45	7,07	7,01	6,96	6,93	6,87	6,81	6,75	6,70	6,58	8,00	9,51
50	6,83	6,77	6,72	6,69	6,63	6,57	6,51	6,46	6,34	8,00	9,72
55	6,57	6,51	6,45	6,42	6,37	6,31	6,25	6,19	6,08	8,00	9,93
60	6,28	6,22	6,16	6,14	6,08	6,02	5,96	5,91	5,79	8,00	10,13

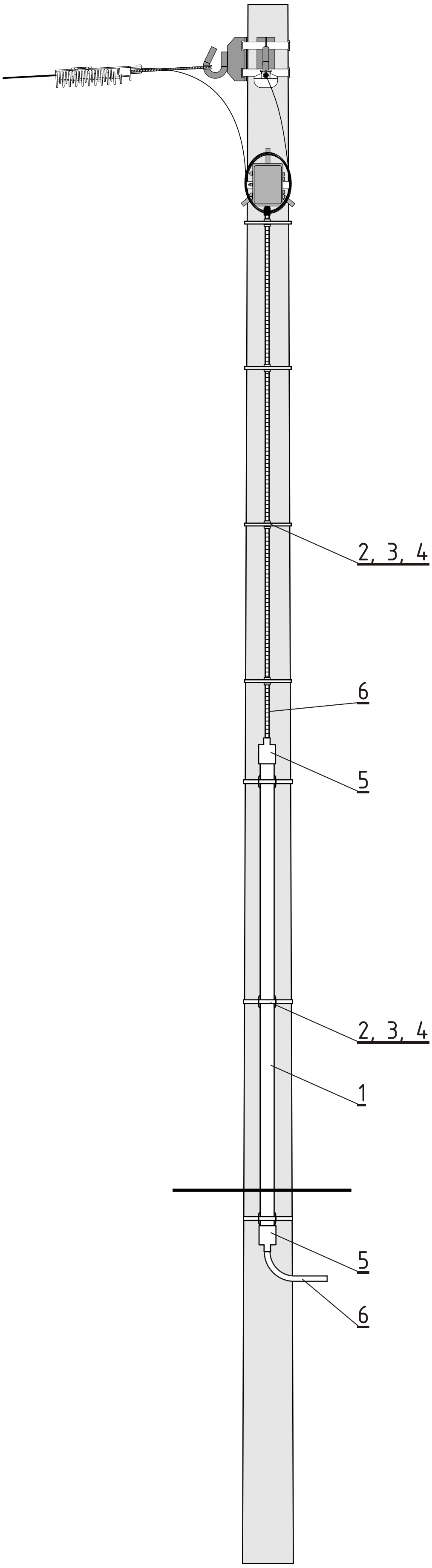
Breakthrough span a = 10,511 [m]				Wire type: ADSS 96J			Basic stress			σ = 8 [MPa]	
Coefficient of thermal elongation			α = 0,000024 [1/°C]		Coefficient of elasticity elongation			β = 0,0041 [MPa]		Stress table	
Wire cross section d = 128,6 [mm2]				Średnica przewodu s = 12,8 [mm2]				Rime load zone SII and SIIa			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,06
10	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,02	0,02	0,13	0,24
15	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,29	0,51
20	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,51	0,88
25	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,80	1,32
30	0,14	0,14	0,15	0,15	0,15	0,15	0,15	0,15	0,15	1,16	1,84
35	0,21	0,21	0,21	0,21	0,21	0,21	0,22	0,22	0,22	1,57	2,42
40	0,28	0,29	0,29	0,29	0,29	0,30	0,30	0,30	0,31	2,06	3,07
45	0,39	0,39	0,39	0,40	0,40	0,40	0,41	0,41	0,42	2,60	3,78
50	0,52	0,52	0,53	0,53	0,54	0,54	0,55	0,56	0,57	3,21	4,54
55	0,70	0,70	0,71	0,72	0,72	0,73	0,74	0,75	0,77	3,89	5,36
60	0,93	0,94	0,96	0,96	0,98	0,99	1,00	1,01	1,04	4,62	6,25

Breakthrough span a = 18,874 [m]			Wire type:ADSS 144J			Basic stress			σ = 8 [MPa]	
Coefficient of thermal elongation		α = 0,000028 [1/°C]		Coefficient of elasticity elongation			β = 0,0042 [MPa]		Stress table	
Wire cross section d = 169,6 [mm2]			Cable diameter s = 14,7 [mm2]				Rime load zone SI and SIa			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	8,00	7,93	7,87	7,83	7,77	7,70	7,64	7,57	7,43	7,88	7,90
10	8,00	7,93	7,87	7,83	7,76	7,70	7,63	7,57	7,43	7,91	7,99
15	8,00	7,93	7,87	7,83	7,76	7,70	7,63	7,57	7,43	7,95	8,14
20	7,98	7,92	7,85	7,82	7,75	7,68	7,62	7,55	7,42	8,00	8,31
25	7,90	7,83	7,77	7,73	7,67	7,60	7,53	7,47	7,33	8,00	8,46
30	7,80	7,73	7,67	7,63	7,56	7,50	7,43	7,36	7,23	8,00	8,63
35	7,68	7,61	7,54	7,51	7,44	7,38	7,31	7,25	7,11	8,00	8,80
40	7,54	7,47	7,41	7,37	7,31	7,24	7,17	7,11	6,98	8,00	8,98
45	7,38	7,31	7,25	7,22	7,15	7,09	7,02	6,95	6,82	8,00	9,16
50	7,21	7,14	7,07	7,04	6,98	6,91	6,85	6,78	6,65	8,00	9,34
55	7,02	6,95	6,88	6,85	6,78	6,72	6,65	6,59	6,46	8,00	9,52
60	6,81	6,74	6,68	6,64	6,58	6,51	6,45	6,38	6,25	8,00	9,69

Breakthrough span a = 13,367 [m]			Wire type:ADSS 144J			Basic stress			σ = 8 [MΠα]	
Coefficient of thermal elongation		α = 0,000028 [1/°X]		Coefficient of elasticity elongation			β = 0,0042 [MΠα]		Stress table	
Wire cross section d = 169,6 [mm2]			Cable diameter s = 14,7 [mm2]				Rime load zone SII and SIIa			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	8,00	7,93	7,87	7,83	7,77	7,70	7,64	7,57	7,43	7,89	7,93
10	8,00	7,93	7,87	7,83	7,76	7,70	7,63	7,57	7,43	7,94	8,12
15	7,97	7,90	7,83	7,80	7,73	7,67	7,60	7,53	7,40	8,00	8,37
20	7,83	7,77	7,70	7,67	7,60	7,54	7,47	7,40	7,27	8,00	8,60
25	7,67	7,60	7,54	7,50	7,44	7,37	7,30	7,23	7,10	8,00	8,86
30	7,46	7,40	7,33	7,30	7,23	7,17	7,10	7,03	6,90	8,00	9,13
35	7,22	7,16	7,09	7,06	6,99	6,93	6,86	6,79	6,66	8,00	9,40
40	6,95	6,88	6,82	6,78	6,72	6,65	6,59	6,52	6,39	8,00	9,66
45	6,64	6,57	6,51	6,47	6,41	6,34	6,27	6,21	6,08	8,00	9,92
50	6,29	6,23	6,16	6,13	6,06	6,00	5,93	5,87	5,74	8,00	10,16
55	5,91	5,85	5,79	5,75	5,69	5,63	5,56	5,50	5,37	8,00	10,40
60	5,51	5,45	5,38	5,35	5,29	5,22	5,16	5,10	4,97	8,00	10,62

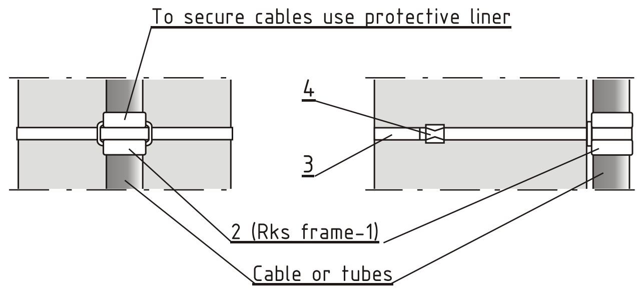
Breakthrough span a = 18,874 [m]				Wire type: ADSS 144J			Basic stress			σ = 8 [MPa]	
Coefficient of thermal elongation			α = 0,000028 [1/°C]		Coefficient of elasticity elongation			β = 0,0042 [MPa]		Stress table	
Wire cross section d = 169,6 [mm2]				Cable diameter s = 14,7 [mm2]				Rime load zone SI and SIa			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	8,00	7,93	7,87	7,83	7,77	7,70	7,64	7,57	7,43	7,88	7,90
10	8,00	7,93	7,87	7,83	7,76	7,70	7,63	7,57	7,43	7,91	7,99
15	8,00	7,93	7,87	7,83	7,76	7,70	7,63	7,57	7,43	7,95	8,14
20	7,98	7,92	7,85	7,82	7,75	7,68	7,62	7,55	7,42	8,00	8,31
25	7,90	7,83	7,77	7,73	7,67	7,60	7,53	7,47	7,33	8,00	8,46
30	7,80	7,73	7,67	7,63	7,56	7,50	7,43	7,36	7,23	8,00	8,63
35	7,68	7,61	7,54	7,51	7,44	7,38	7,31	7,25	7,11	8,00	8,80
40	7,54	7,47	7,41	7,37	7,31	7,24	7,17	7,11	6,98	8,00	8,98
45	7,38	7,31	7,25	7,22	7,15	7,09	7,02	6,95	6,82	8,00	9,16
50	7,21	7,14	7,07	7,04	6,98	6,91	6,85	6,78	6,65	8,00	9,34
55	7,02	6,95	6,88	6,85	6,78	6,72	6,65	6,59	6,46	8,00	9,52
60	6,81	6,74	6,68	6,64	6,58	6,51	6,45	6,38	6,25	8,00	9,69

Breakthrough span a = 13,367 [m]				Wire type: ADSS 144J			Basic stress			σ = 8 [MΠα]	
Coefficient of thermal elongation			α = 0,000028 [1/°X]		Coefficient of elasticity elongation			β = 0,0042 [MΠα]		Stress table	
Wire cross section d = 169,6 [mm2]				Cable diameter s = 14,7 [mm2]				Rime load zone SII and SIIa			
a	-25[°C]	-15[°C]	-5[°C]	0[°C]	+10[°C]	+20[°C]	+30[°C]	+40[°C]	+60[°C]	-5sn	-5sk
5	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,05
10	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,11	0,20
15	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,25	0,44
20	0,06	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,44	0,76
25	0,10	0,10	0,10	0,11	0,11	0,11	0,11	0,11	0,11	0,68	1,15
30	0,15	0,15	0,16	0,16	0,16	0,16	0,16	0,16	0,17	0,99	1,60
35	0,21	0,22	0,22	0,22	0,22	0,22	0,23	0,23	0,23	1,34	2,12
40	0,29	0,29	0,30	0,30	0,30	0,30	0,31	0,31	0,32	1,75	2,69
45	0,39	0,39	0,39	0,40	0,40	0,40	0,41	0,41	0,42	2,22	3,32
50	0,50	0,51	0,51	0,52	0,52	0,53	0,53	0,54	0,55	2,74	4,00
55	0,65	0,65	0,66	0,66	0,67	0,68	0,69	0,70	0,71	3,31	4,73
60	0,83	0,84	0,85	0,85	0,86	0,87	0,88	0,89	0,92	3,94	5,51

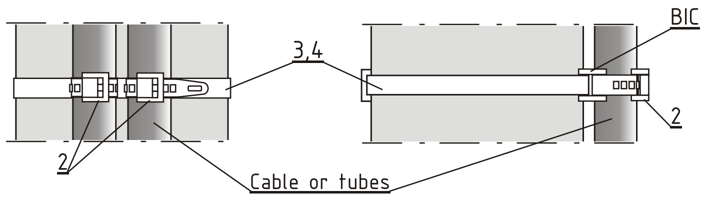


Fixing the cable to the pole
Assembly details

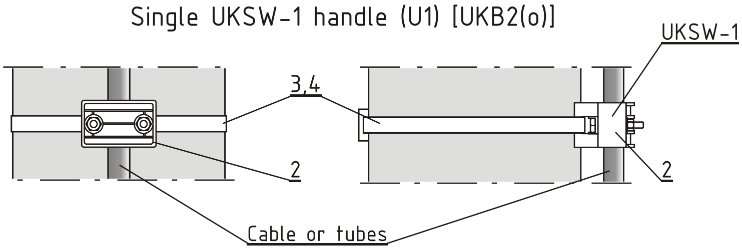
Rks frames



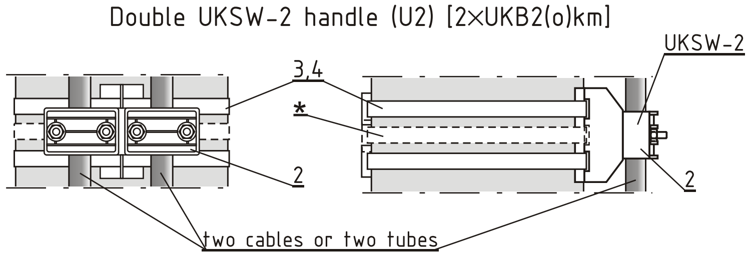
BIC handle



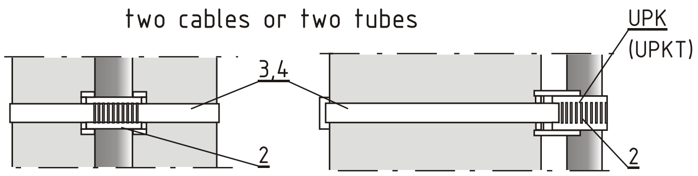
Single UKSW-1 handle (U1) [UKB2(o)]



Double UKSW-2 handle (U2) [2×UKB2(o)km]



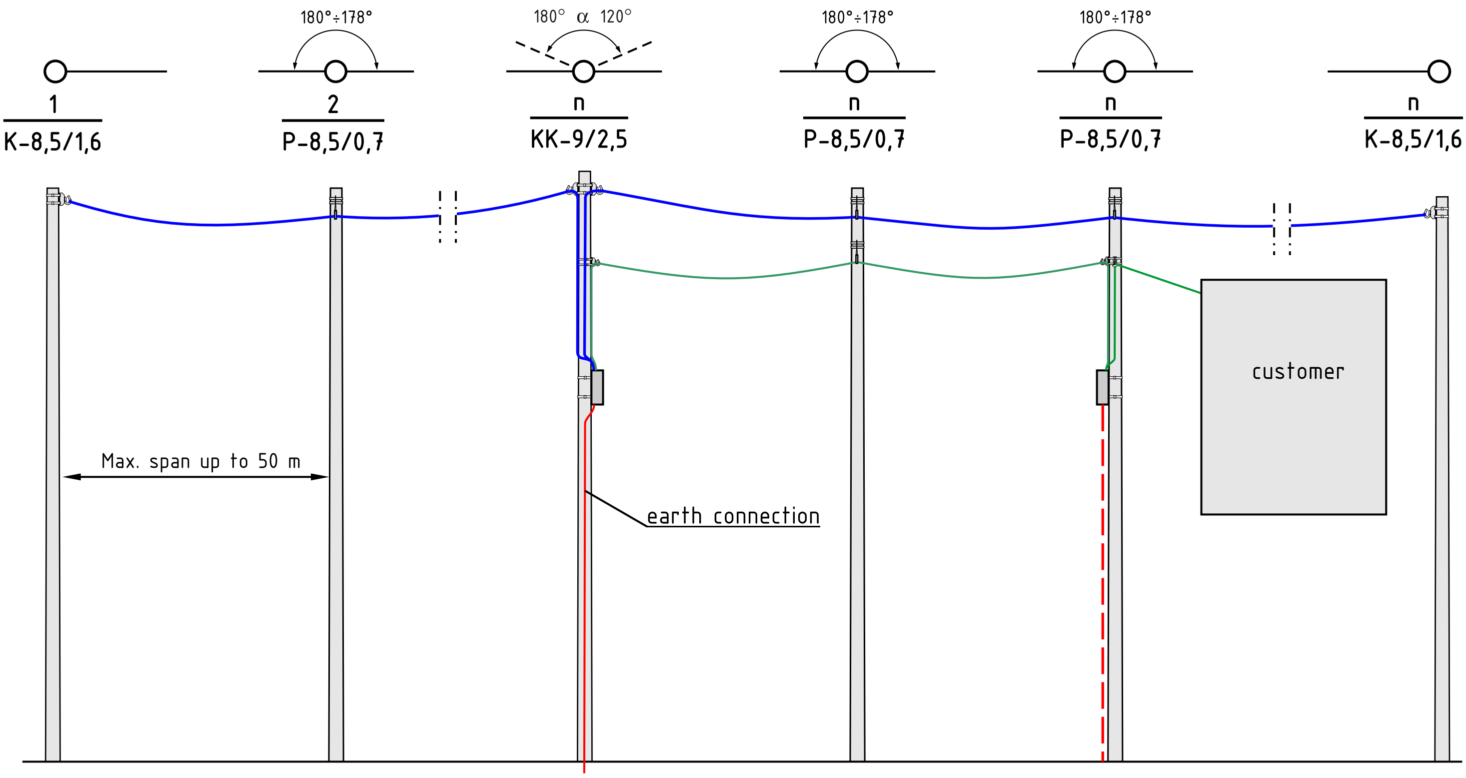
two cables or two tubes



Single tape for attaching the handle 2xUKB2(o)km
*

No.	Specification	Unit	Quantity
6	Protective tube OPTO	m	1
5	Heat shrink breakout boots	pcs.	2
4	Clasp	pcs.	6
3	Steel tape	pcs.	6
2	Cable holder	pcs.	6
1	Casing tube BE 32	m	3

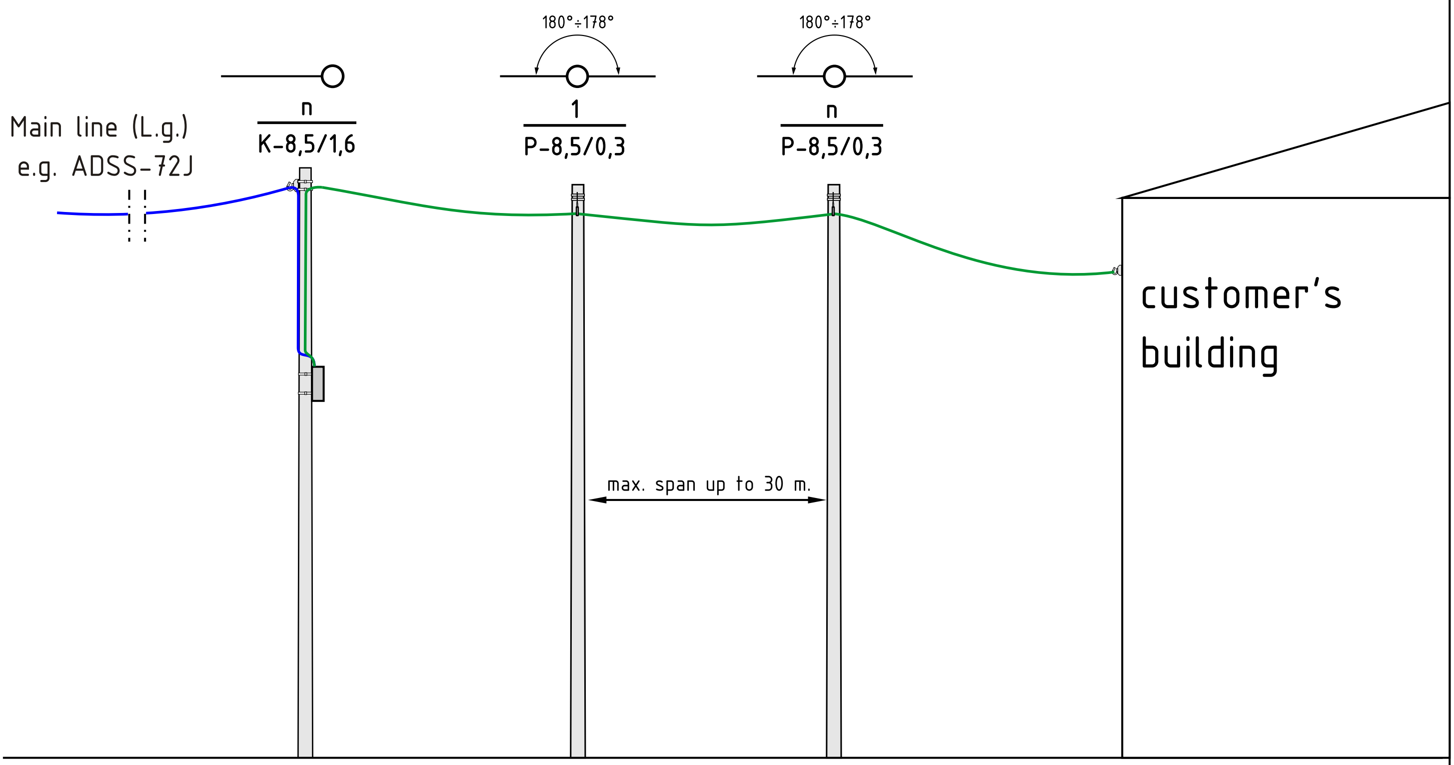
Examples of technical lines with connections



Main line type TL3 – ADSS cable – 144J tension 8 MPa – 135 daN (upper cable)

Connection cable type MADC 2J – tension 65 MPa – 22 daN (bottom cable)

Example of a branch-off from the main line using an overhead connection via MADC 2J cable on poles with an effective force of 0,3 kN.



ABOUT US

MADE IN POLAND

As a leading designer, we produce composite and aluminum lighting and construction solutions.
We constantly care about technological development as well as improving the quality of our products.
Our research facilities, close cooperation with scientific centers partnerships with experienced entities from the design industry allow us to constantly improve the strength and resistance parameters of polymer composite structures.
With over 20 years of experience, we constantly look for new composite applications, ensuring that the properties of this material are used more in the energy and railway industries, and also the road and advertising infrastructure.

AREAS OF APPLICATION

ROADS | RAILWAY | ENERGETICS | INFRASTRUCTURE OF LOCAL GOVERNMENT UNITS | DEVELOPERS | COMMERCIAL BUILDINGS | RECREATIONAL FACILITIES | HoReCa | FUEL STATIONS | OTHERS

OTHER PRODUCTS AVAILABLE IN OUR OFFER

Please contact us if you have any questions.
We will be glad to prepare the offer adjusted to your needs.

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